The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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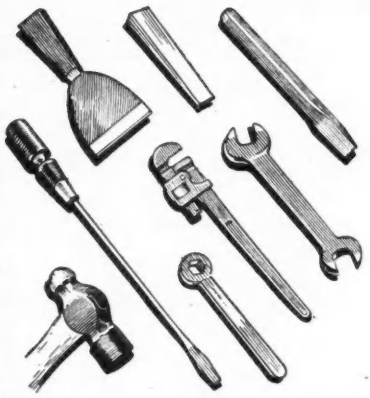

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Multiple-Effect Evaporation

SOME of our readers are not chemical engineers. Most chemical engineers know all about the subject we propose to discuss here. As the Duke of Plaza-Toro said on a momentous occasion: "I am now about to address myself to the gentleman whom my daughter married; the other may allow his attention to wander." So we shall address ourselves to those who are not chemical engineers of the first magnitude; the others may allow their attention to wander. Multiple-effect evaporation, which is well known in many branches of the chemical industry, was the subject of a paper by Mr. D. M. Semple at a joint meeting of the Chemical Engineering Group and the Institution of Chemical Engineers in Glasgow. Although, as we have said, many know all about this rather wonderful process, it is surprising how many people do not. The latter class includes a remarkably large number of engineers who do not happen to have been engaged where these machines are used.

The essential importance of the process, to-day, lies in its potentialities for saving fuel and in showing those who do not possess a multiple-effect evaporator how they can save fuel in much the same way and without using one of the machines. Those who have studied the properties of steam know that its heat content consists in part of latent heat and in part of sensible heat. The latent part is much the larger of the two. It has been pointed out that if the heat latent in the steam were sensible, the steam would have a temperature of well over 1000° C.; the curious can work out for themselves just what it would be. If steam melted the pipes through which it passed, we should immediately recognise that its latent heat was of some real use. But because it escapes as a plume of pleasant white vapour, no one thinks anything about it. Yet in potential heating value this exhaust steam is of peculiar worth. As the pressure under which steam exists is decreased and its temperature similarly decreases, its latent heat increases. The text-book figures of 970 B.Th.U. per lb. which we all remember from student days only refers to atmospheric pressure. Thus, in round figures, steam at 250 lb. absolute has a latent heat of 825 B.Th.U. per lb. and a total heat of 1201 B.Th.U. per lb. At 100 lb., the latent heat has increased to 889 B.Th.U., but the total heat is still almost the same, 1187 B.Th.U. to be precise. At an atmospheric

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pressure of 14.7 lb., the respective figures are 970 and 1150, while at low pressures, say 1 lb./sq. in. abs., the figures are 1036 and 1106. These figures, elementary though they may seem to steam engineers, are given here to emphasise our point that because steam is exhaust steam, it is not therefore *waste* steam.

The multiple-effect evaporator was devised as long ago as 1850 by Rillieux for reasons of fuel economy. The sugar industry had a particularly difficult problem in that it produced a great deal of waste fibre which had to be got rid of; but when that was burnt, there was no other fuel available. Consequently, there was no point in being more efficient thermally than was required by the available supplies of waste fibre, but it was necessary to be as efficient as that so that no additional fuel would be needed. To meet this situation the multiple-effect evaporator was devised. An evaporator with two or three effects is satisfactory for these circumstances. When absolute economy in fuel is needed, as in Great Britain's beet sugar industry, four or five effects are required. Apparently, to judge from Mr. Semple's paper, five is thermally the most efficient number. The problem is a difficult one. A clear solution containing 14 to 16 per cent. of solids must be evaporated to a syrup containing 50 to 60 per cent. of solids. This means, if by some miracle our arithmetic is correct, that for every ton of sugar in the liquor some 5 tons of water must be evaporated. Quite a lot of heat is needed to do this. Other industries have the same problem, though in different forms. There is not all that difference between using heat to evaporate water and using it for power, for process heating, for space heating, and for the provision of hot water.

The evaporator under consideration operates by using the latent heat in the vapours from the evaporation conducted in any one stage to heat the next stage. Thus, in Mr. Semple's "typical operating conditions," 1 lb. of steam entering the first vessel brings with it 1097 B.Th.U., and the 0.97 lb. of steam generated in that vessel by evaporation carries with it 1062 B.Th.U. This passes on to the next vessel where it serves as the heating medium, and evaporates more water, and so on. Naturally, as the steam temperature drops from vessel to vessel, the pressure at which evaporation takes place must be lowered progressively. Why cannot we use this principle more in our general works practice?

Steam can be used for power generation; the exhaust can be used for process heating; the exhaust from process heating can be used for other processes at lower temperatures or for factory heating, for hot water, and for heating the boiler feed. The economiser —which, *of course,* is taking the waste heat from the boiler plant—can be used either as an economiser or as a method of producing hot water (for this purpose any old economiser too ancient for regular service will do); the vapours leaving the process plants can be collected and sprayed with fresh water, thereby using their very great quantity of latent heat to produce more hot water. The economies that can be made by these methods are very great indeed. With real ingenuity and the use of old scrapped plant, it can generally be found possible to use steam three or four times over in any works that needs both power and low-temperature heat. Not only is this not a matter from which the chemical engineer's attention must not be allowed to wander, but it is the chemical engineer who must put it into practice.

NOTES AND COMMENTS

Fuel Economy Progress

NOTWITHSTANDING the success which has crowned their initial efforts—aided by the milder weather last winter—Dr. Grumell's Fuel Efficiency Committee are in no mind to rest on their laurels, even though it is clear that the interest of industry in fuel—too long a forgotten subject—has been awakened as never before. The conference which was opened last month in London by Major Lloyd George was the biggest meeting on fuel that has ever taken place in this country. It was attended by nearly 1000 delegates, whose enthusiasm was unmistakable. This will be followed up by further meetings in different provincial centres. The Ministry has agreed to address one in Glasgow on July 8/9, the Scottish Regional Fuel Efficiency Com-

mittee of which Sir Patrick Dollan is chairman having been particularly successful. There is no doubt that the space given to fuel economy news by the Press has been of substantial assistance in the progress. Another factor which shows how wide is the interest in fuel economy is that over 20,000 fuel watchers' badges have been *applied for* by industrial firms. One of the most important steel works in Sheffield estimates that their system of fuel watching is saving them over £10,000 a year. There has been a shortage in this country of engineers trained in fuel technology, and with all the other demands on engineers' time at present it is remarkable that nearly 650 have volunteered to serve on the panels set up by Regional Controllers throughout the country. These engineers systematically visit the works of all large coal consumers and advise how economies are to be made. During the last winter, over 11,000 factories were visited which consume nearly 29,000,000 tons of coal a year. As regards the savings which have been made, engineers do not like to be tied down to definite figures, but the estimates vary between 8 and 12 per cent. on a conservative average.

Canadian Post-War Industry

CANADIAN manufacturing industries are at work on plans for post-war readjustment. The pulp and paper industry, the iron and steel industries, the chemical industry, and electric power producers, to mention only a few, are preparing programmes of rapid reconversion to civilian production and adjustment to changed conditions. Improvements in industrial practices, simplification of methods and new processes developed for war production will all continue to be employed. Concentration on manufacturing for war purposes, however, has drawn a proportionately larger number of employees into manufacturing than it supported in pre-war days. Necessary readjustments in this employment and the absorption of the men returning from military service will require, during at least an interim period, co-operation from all the Dominion's governments and industries. As in most belligerent countries, the "small man" in Canada has in many instances been put out of business, and a recent "Monthly Letter" from the Royal Bank of Canada gives some details of how these "dead" concerns will be resuscitated after the war, and of how the creation of new small-scale local enterprises will be encouraged.

Processing Local Products

THE recently issued interim report of the Post-War Rehabilitation Council of British Columbia, for example, in a survey of the industries and natural resources of the province, indicates thorough study of post-war problems. The great forest resources of the province have naturally been a matter of first attention, but the proposals also include the utilisation of natural resources for the establishment of small industries —local plants to process the products of the district and provide industrial opportunities in the agricultural and fishing areas. These would include cheese factories, fish-curing establishments, other food-processing plants, and small industries utilising waste products of the timber industry. In view of the rapid developments in cellulose chemistry in recent years, there would appear to be wide opportunities here for the establishment of a chemical industry based on wood. Other provinces have not yet published reports on as comprehensive a scale as British Columbia, but the enormous extension of the manufacture of chemicals and chemical plant in the Eastern Provinces will surely not be allowed to run to waste.

India's Chemical Needs

A NEW variation on the all-too-familiar "frustration of science" theme is developed by an Indian scientist, Mr. H. Ghosh, of the Standard Pharmaceutical Works, Calcutta. In an article in the latest issue of *Science and Culture* he calls attention to the serious shortage of anti-malarials and other drugs in India, and attributes it to the absence of basic chemical industries. Sulphuric acid is the only basic chemical being produced there, and he says that even its production is only on a small scale. India produces no phosphoric, citric, acetic, or tartaric acid. Sulphanilamide drugs cannot be made because no chlorosulphonic acid is available. Mr. Ghosh also comments on the lack of coal distillation products of Indian origin. It seems that stacks of coal are burnt in the open for the produc-

tion of coke, the important volatile products being allowed to escape. He adds that while two or three coal-distillation concerns have come into being since the war began their products are mostly requisitioned by the Government for war production so that the supplies for pharmaceutical firms are inadequate. The irony of the situation lies in the fact that India's natural resources in coal, wood, aluminium, iron, copper, iron pyrites, and so on, are enormous.

Research in a Vacuum

MR. GHOSH maintains, with much justification, we think, that India's self-sufficiency in the supply of medicines and drugs depends mostly, if not entirely, on the development of basic chemical industries. He blames the absence of these industries on foreign vested interests which have worked, he says, against the development of coal and wood distillation, acid production, and the making of ammonia and other alkali products. Yet he holds that there are many capitalists in India who could raise sufficient capital to start the required basic industries on a large scale provided that they could rely on the Government's help in such matters as the importing of machinery. The one bright spot in Mr. Ghosh's sombre picture—a sorry spectacle, indeed, in comparison with the achievements of China which we described recently—is provided by the Board of Industrial and Scientific Research. This organisation, set up about two years ago, has made an excellent start. Limitations on its usefulness are imposed, however, by the scale and structure of India's industry. The results of its researches could be applied far more fruitfully if there could be close collaboration between the experts of the Board and the experts of the manufacturing concerns. As it is, the Board is somewhat in the position that would face our D.S.I.R. if there were no industrial research associations nor adequate laboratories belonging to commercial companies. The difficulties of large-scale production cannot be precisely forestalled by laboratory research work alone, so that the results and work carried out by the Board often cannot be applied commercially. As with the hen and the egg it is not possible to say which comes first, the individual industries or the inventions and discoveries arising out of research. Consideration of India's plight leads one to the conclusion that research without industry is as futile as expecting to get an egg without a hen or a hen without an egg. The problem is: shall India have chemical industries of her own, or must she remain dependent upon the western hemisphere?

Vitamins for Europe

THE chemical industry will have an important part to play in the first-aid stage of food relief on the Continent when the United Nations invade. This view is maintained in a new book, "Starvation in Europe," by the Australian-born biochemist, Dr. Geoffrey H. Bourne, now working at Oxford. He disagrees with those nutrition experts who say that it is better to use natural foods as a source of vitamins than to use concentrates and synthetic preparations, and calls attention to the fact that vitamin-C tablets can be flown to a particular town in a few hours, whereas the transport of even orange juice and black-currant concentrates would involve much slower transport. The indications are that before the war is over there will be a considerable amount of scurvy, especially in some areas, and we shall therefore need to use every form of vitamin C we can lay our hands on.

Synthetic Production

BRITISH, American and Swiss factories produce considerable quantities of vitamin C. Germany is said to have erected this year several new vitamin factories and if they fall into our hands undamaged they will serve to supplement the supplies from Allied factories and from Switzerland. Riboflavin deficiency is also likely to be widespread, and Dr. Bourne holds that there is a case for increasing the amount of plant available for the manufacture of synthetic riboflavin. The provision of adequate supplies of vitamin D, too, should be settled now. Dr. Bourne's final comment is that it is most important that some authoritative body should immediately assess what supplies of synthetic vitamins the Allied Nations are likely to have in stock for food relief purposes, and to estimate what the requirements of Europe are likely to be. If it is obvious that there is a large discrepancy between the two amounts a start should be made now to extend the Allied Nations' factories for synthetic vitamins.

Fires at Chemical and Allied Works

by JOHN CREEVEY

THE outbreak of fire is avoidable. The direct causes may be unguarded or uncontrolled flame, glowing material, spontaneous heating and spontaneous igniting of material, electric sparks or short-circuiting, friction with the development of heat passed on to ignitable material, the focussed rays of the sun, spontaneous chemical reaction in mixtures or material in contact, direct oxidation of dangerous products which have become exposed to the air, heat from steam pipes, and so on; but be the cause what it may, the outbreak occurs and makes progress for two main reasons. First, because it is probable that any risk of fire, apart from causes which would be too obvious, is never suspected; secondly, because no particular precautions have been taken against the risk of fire, even where it is not regarded as quite unlikely.

New Employees

With these points borne in mind it is well to make a tour of the works to see where a little more attention to details of fire safety may be enforced, or perchance—in certain circumstances—shall we say, encouraged. Now that industry has taken into its ranks many new recruits who have hitherto been unused to the environment of a works, especially works where chemicals and heat and flame are in use, it must not be forgotten that they are a little unmindful of the dangers which may come by ignorance or by neglect of attention to detail, often seemingly minor detail. A general safety talk to new employees by the works safety officer, or some person responsible for the safety of the works, has always been stressed as being desirable for preventing accidents, and its value is certainly emphasised by the conspicuous absence of certain types of accident at works where this talk has been common practice, especially as regards personal injury from accidents. There is, however, a particular need for more attention to be given to the preventing of outbreaks of fire; employees may acceptably be told how to quell an outbreak, and how to behave as regards their own duties if fire occurs or an alarm be sounded, as well as to receive fire-fighting instruction as part-time members of the works brigade; but it is also well for all employees to know just how fires occur and how neglect in certain matters of works routine contributes largely to the rapidity with which an outbreak will spread.

As to fire-fighting instruction, this may in convenient circumstances be given by an officer of the local fire brigade, not overlooking the need—a particular need—of being conversant with the method of using the particular type of fire extinguisher in use at the works, and perhaps a little less of the "fire drill by numbers" which has been the delight of the compilers of certain war-time fire-fighting instructions. The hose running and coupling procedure may well be left in the hands of those employees who are members of the works fire-fighting squad. For the rest, and "the rest" includes all employees irrespective of their status or duties, there is very great need to know the right and wrong manner of using hand extinguishers, and also to learn where—by reason of the nature of the outbreak—the extinguisher needs particular caution in use or may be undesirable or even dangerous.

Moreover, great emphasis must be laid on the fact that there is a difference between "reasonable speed" and "great hurry," with the excitement attendant upon the latter state. True, a fire can spread with great speed, but there is no need to set about the task of quelling it or keeping it under control—until the arrival of other help—with undue commotion and "great hurry, brushing aside all commonsense," for apart from other things it may happen that an extinguisher fails to operate or a considerable part of its fire-quelling property comes to be uselessly expended by haste too great in bringing the extinguisher to the fire or in failing to direct the stream of extinguishing liquid or vapour at the actual seat of the fire.

A Calm Outlook

We well remember an outbreak in the cellars below some storage buildings, where more than one willing helper in carelessly carrying an extinguisher to the scene of the fire actually set his extinguisher in action inadvertently, and then became a direct menace to all others who crossed his path! There is, indeed, really only one way to ensure a calm outlook in the face of an outbreak, for employees who promise to prove too hasty or careless, and that is for them to have actual practice with an extinguisher and a demonstration fire.

Over and above the actual method of attack on an outbreak, all employees must know what to do in the matter of giving an alarm, and, if the nature of their works duties warrants it, they must have detailed instructions as to leaving plant unattended or safeguarding material which is known to be dangerous and adjacent to the position of the fire. Correct knowledge of duties in the case of outbreak of fire is far more desirable than "lining up like so many mechanical robots and numbering off by two and two," as we witnessed at one

large works where commonsense instruction was largely overborne by official literature.

As to knowledge concerning the causes of outbreak of fire, it should be arranged that responsible foremen and others be taken a tour of the works and there—on the spot—have pointed out to them some of the places where fire might easily originate by negligence, for instance where inflammable material is left lying about in heaps, or where oily waste has been allowed to accumulate, or the bung of a drum containing inflammable liquid has not been replaced, even if only temporarily. Emphasis must be laid on the time incidence of fires in general, with the period between 6 p.m. and midnight showing the greatest number of outbreaks according to collected statistics. The greatest danger hour was found to be commonly between 8 and 9 p.m., showing that a fire once started makes progress and becomes a real conflagration when the building has been closed for the night and there is no one present to observe it. This danger period is, of course, now somewhat offset by continuous working under war-time conditions, or at least by war-time fire-watching regulations, but still it is the hours between 6 p.m. and midnight which show the greatest incidence of outbreaks, and it is suspected that this is promoted by the inherent tired feeling of night workers coming direct to work after having spent their day otherwise than in resting, as also to a cause, proved by experiment, that at certain hours of the clock the human mind is a little less receptive of external detail and less watchful, just as the capacity of the mind for concentrated brain work increases at certain hours of the night when all is quiet.

Improper storage conditions, as likewise the adjacent storage of so-called "incompatible" materials, have been the cause of many outbreaks of fire. For this reason, at chemical works and wherever chemicals are used in industrial processing, those having charge of them either in storage or in use should be made acquainted with their properties. Very stringent regulations are in force regarding the carriage of dangerous goods by rail and by ship, but the stringency of regulations regarding storage at users' works has a long way to go to become all that is desirable. Straw packing in contact with strong mineral acid containers is particularly hazardous, and it must be remembered that all fibrous materials offer danger because of the large proportion of air space relative to their weight. Even when the material itself if not particularly combustible, the air channels in a stack offer great inducement for spreading flame from an adjoining source of fire.

Potassic Flue Dust

Fertiliser from Ferro-Manganese Furnaces

by M. LERNER

USE was made during the last war of potash-bearing waste products, for fertiliser purposes, in this country and the United States, to make up for the shortage of imported potash. Whereas this practice was discontinued here after the war, America went on with it; there was, therefore, no need for the Americans to carry out new investigations when potash became scarce once more at the outbreak of the present war. We, in the United Kingdom, were, however, compelled to try and rebuild from what had been allowed to break up 20 or 25 years ago. The idea of collecting and treating industrial dust (containing potash), which used to be destroyed or left to waste, was taken up by my firm in September, 1939. Assisted by the Government Laboratory and the supplying works, my firm spent more than a year on research and other preparatory work. In most cases, industrial dust was found to be useless for our particular purposes, as it contained no potash, or only traces. Reasonable percentages of potash were found, however, in flue dust from a number of ferro-manganese furnaces. A certain lead was given by records from the last war, although it was found that flue dust from furnaces that contained a high percentage of potash during 1917/1918 now contained little or no potash, owing to changed methods of manufacture and different basic raw materials.

Before products were brought on the market they were kept under constant chemical observation—in most cases for a whole year—as to their potash content and freedom from cyanides and other toxics that might have been harmful to plant life. First deliveries on a commercial basis were made during January, 1941. Since then, more than 20,000 tons of this home-produced material have been sent out to farmers, with excellent results, a very welcome addition to potash supplies, which has at the same time the effect of saving shipping space for other essential imports.

The following table contains a typical complete analysis of the dust.

Moisture	3.0%
Carbon	4.0%
Silica	13.5%
Ferrous Iron (Fe)	12.1%
Ferric Iron (Fe_2O_3)	21.5%
Alumina (Al_2O_3)...	10.0%
Lime (CaO)	10.0%
Potassium (K) ... ... (equal to 7.98% K_2O)	6.6%
Sodium (Na)	1.9%
Magnesium (Mg)	0.8%
Zinc (Zn)	0.6%
Manganese (Mn)	0.8%
Carbon dioxide (CO_2)	6.4%
Sulphates (SO_4)	0.4%
Sulphides (S)	0.4%
Chlorides (Cl)	3.0%
Phosphates (P_2O_5)	0.6%
Cyanogen (CN)	Nil
Combined water and undetermined ...	4.4%
	100.0%

Another assay report, that of the Government Laboratory in February, 1941, gives the following analysis: arsenic negligible, lead 0.1 per cent., zinc 0.2 per cent., selenium 4 parts per million, and cyanide nil. The Kent County Analyst in February, 1941, reported "A small trace of cyanide present was of no consequence." In December, 1941, a sample analysed by Mr. Albert E. Parkes was found to contain 12.6 per cent. of potash (K_2O); equal to 23.3 per cent. of potassium sulphate; no cyanides or sulphides were found, while there was a small quantity of iron and manganese present but so-called poisonous metals were absent. A sample examined in December, 1942, contained no potassium cyanide, 0.13 per cent. thiocyanide of potassium, and 0.04 per cent. ferrocyanide of potassium.

Method of Application

Flue dust can be used for direct application to the land and for compounding. It is not recommended in conjunction with sulphate of ammonia but may be mixed with basic slag, phosphates and organics. It can be dug, hoed, harrowed or ploughed in or applied by ordinary fertiliser drill. The recommendation is made that it should be worked well into the soil several weeks before sowing, but excellent results have also been achieved with simultaneous sowing of seed and flue dust by combined drill, which is, of course, time, money and labour-saving. It is not recommended for top dressing, but is suitable as potash base for most compound fertilisers. There are no restrictions as to the crop for which it may be used, or the quantity that may be applied per acre; War Agricultural Executive Committee certificates are not required. It is not possible to make exact statements in a general report as to the quantity that should be applied. As a guide, it may be mentioned that as a rule 5-15 cwt. per acre are applied for potatoes, 5-10 cwt. for other root crops, 5 cwt. for wheat, oats, barley, peas, beans. Larger quantities should be applied on heavy clay or peaty soils with large water-holding capacity than on dry, sandy soils.

It is recommended and has been used successfully for potatoes, mangold, turnips, swedes, wheat, oats, barley, peas, beans, apples, soft fruit, outdoor tomatoes, flax, onions, permanent pasture, ploughed-up poor grassland. Large-scale tests are at present being carried out for rye and sugar beet, and there is no apparent reason why it should not prove successful. It is expected that the manganese in the flue dust will assist in preventing "yellows" of sugar beet, which is a mineral deficiency disease.

Rapid Action

Potassic flue dust is a quick-acting fertiliser. "Three—or even more—actions in one product and one application" aptly describes it. It releases potash that may still be in the soil from earlier seasons, and it supplies new potash and lime. An additional action is that it keeps wire-worms and other pests of the soil away from seed and plants just at a time when this is most important, that is when plants are still young; thus, after having provided them with the potash they require, this same flue dust, by keeping soil pests away, gives young plants the chance to develop strength and thereby assists in overcoming root and stem diseases. It appears, furthermore, that this flue dust supplies trace elements, which during recent years have been found necessary to keep both plants and the stock which feeds on them, in good health.

Comparative figures of crops with flue dust and sulphate of potash are interesting. The results of three series of field trials are given in the table below.

[Crop yields in three series of field trials in which flue dust was applied to potatoes.]

	Total weight of crop per acre. Series 1 Tons/Cwt.	Series 2 Tons/Cwt.	Series 3 Tons/Cwt.
Amount of potash supplied:			
No potash: (control experiment)	5.2	8.2	7.10
Flue Dust: 4½ cwt.	5.18	8.2	7.10
Sulphate of Potash: 1 cwt.	5.18	10.3	9.19

American Chemical Society Meeting

Abstracts of Industrial Chemical Papers

THROUGH the courtesy of the American Chemical Society we are again able to publish some abstracts of papers presented at the meeting of the Division of Industrial and Engineering Chemistry, held at Detroit in April. The first of the general papers was on "Ion Exchange Resins, New Tools for the Process Industries," by F. J. Myers, Resinous Products and Chemical Company, Philadelphia. Ion exchangers, said the author, have hitherto found only limited use in special chemical processes, this slow development being due to physical and chemical limitations imposed by the available exchange materials. With the advent of the resinous cation exchangers and acid adsorbents several new processes have become available to industry. The value of the cation-anion exchanger system to produce pure de-ionised water is proved conclusively by data obtained from a number of commercial-size units. Excellent results have also been obtained by application of the de-ionising process in other industries, *e.g.*, the purification of sugar juice by removing inorganic salts and other impurities before evaporation.

Resinous Flameproofing Compositions

In an extensive survey of the literature and patents on this subject A. J. Snyder and P. S. Hewett, of Reichhold Chemicals, Incorporated, Detroit, show that a large number of different materials have been tried, but manw of them had undesirable properties while some could not be prepared on a large scale as they contained critical raw materials, such as antimony, aluminium, zinc, tungsten, and tin. As a result of this survey, numerous resinous flame-retardant compositions were prepared and tested against the commercially available fireproofing agents. The most suitable resin was found to give fire resistance when brushed, sprayed, or impregnated into plywood. Wood treated in this manner was found to possess a surprising degree of water resistance, and this resin has also been found useful in treating other materials, such as textiles, fibres, and paper.

Methyl Lactate Production

A continuous method for dehydrating lactic acid and preparing methyl lactate and methyl alpha-acetoxypropionate is explained in a paper by E. M. Filachione, M. L. Fein, C. H. Fisher, and L. T. Smith, Eastern Regional Research Laboratory, U.S. Department of Agriculture. When pyrolysed, methyl acetoxypropionate yields methyl acrylate, a valuable synthetic rubber and resin intermediate. As precursors of methyl acrylate and rubber-like plastics, methyl lactate and its acetyl derivative, methyl acetoxypropionate, are important, and accordingly the attention of the laboratory has been devoted to the development of cheap and efficient methods of making these two esters. It has been found that aqueous solutions of lactic acid can be converted satisfactorily into methyl alpha-acetoxypropionate by a simple three-step process, giving maximum yields of over 90 per cent.

A further paper on the "Production of Methyl Acrylate by the Pyrolysis of Methyl alpha-Acetoxypropionate" by Messrs. Fisher, Smith, and P. Ratchford, of the Eastern Regional Research Laboratory was concerned with the pyrogenic production of methyl acrylate from methyl alpha-acetoxypropionate, which is obtainable in quantity from abundant carbohydrates by the following operations:
(1) Carbohydrates → lactic acid (fermentation); (2) lactic acid plus methanol → methyl lactate; (3) methyl lactate plus acetic anhydride or ketene → methyl alpha-acetoxypropionate.

The synthesis and reactions of ketene was the subject of a paper by W. A. Allen and E. F. Degering, Purdue University, Indiana. A critical study of the reaction between ketene and butanone to yield 2-butene-2-yl acetate, shows that the optimum conditions for the reaction on a batch scale are with a rate of flow of ketene of 0.25 mole per hour through 0.784 mole of butanone in the presence of 0.007 mole of sulphuric acid at a temperature of 75° C. The conversion for a single passage of ketene is about 39 per cent. No attempt was made to recycle the ketene and thus determine an over-all yield. Some polymerisation of ketene occurs but this is decreased by increasing the temperature of operation. Sulphuric acid was the best of the catalysts studied and the conversion of the butanone to 2-butene-2-yl acetate increases with the reaction time.

Titanium Sulphate

Several investigators have shown that the precipitation times of boiling curves obtained by boiling commercially important titanium sulphate solutions having a given ration of titanyl sulphate to acid are not a simple function of the titanium concentration. In a paper entitled "The Hydrolysis of Titanium Sulphate Solutions," A. W. Hixson, Columbia University, N.Y., and R. E. C. Fredrickson, Staley Manufacturing Company, concern themselves with this apparently abnormal hydrolytic behaviour. It was shown for the first time that when

titanyl sulphate, $TiOSO_4.2H_2O$, was dispersed in water, it hydrolysed rapidly to a more basic compound, $2TiO_2.SO_3$, which then hydrolysed slowly to form increasingly basic substances which precipitated from the solution. Some evidence was also obtained indicating that the two titanium atoms in $2TiO_2.SO_3$ reacted at different rates with hydrogen peroxide. Light absorption characteristics of sulphuric acid dispersions of titanyl sulphate were correlated with peculiarities in the precipitation time of boiling curves. The previously observed peculiarities were found to be the result of peptisation. The titanium oxide precipitates obtained under conditions where the basic compound $2TiO_2.SO_3$ was a hydrolysis intermediate were not easily peptised and therefore gave normal precipitation-time curves. The two types of hydrolysis were correlated with the absorption spectra of the solutions.

Pine Solvents

R. C. Palmer of Newport Industries, Inc., Pensacola, discussed the various solvents obtained from pine trees. He said that the annual production in America of these solvents probably does not exceed 50 million gallons, but this relatively small amount is, however, supplying many special uses. Production is by four important methods. The time-honoured collection of oleoresin from the living tree and separating the volatile solvent in small-scale, simple equipment located adjacent to the forest still produces a substantial quantity of turpentine oil, but this system is now adopting modern engineering methods in large central refineries. Second in volume is the solvent extraction of dead wood. This comparatively young branch of the industry has made rapid progress in developing derivatives which, like many other true solvents, also have important chemical uses. A large potential source of terpenes lies in the pine pulp and paper industry; only a portion of the mills recover the oils at present. A large quantity of fatty acids and other by-products should be available from this source when production and engineering problems have been solved. The destructive distillation of pine wood, an old process, is the fourth important method of yielding solvents as well as a number of chemical by-products. Alpha-pinene is the only solvent common to the four methods, but it, too, is the starting chemical for many possible derivatives. Each of the major sources yields important products distinctive to the particular process.

Water Treatment

The majority of the papers presented to the water, sewage and sanitation section dealt with the purification of water used in industry. The use of sodium fluoride to prevent algæ and slime growths, and of sodium dichromate as an inhibitor of oxygen corrosion were described by V. L. King, C. H. Bean, R. E. Lester, and W. Rudolfs.

Some chemical aspects of the ammonia-chlorine treatment of water were considered by W. A. Moore, S. Megregian, and C. C. Ruchhoft, of the U.S. Public Health Service. The authors state that despite much work on the part of a large number of investigators, the information available on the nature of the reaction between chlorine and ammonia when these two chemicals are present in small quantities in water is unsatisfactory, as the complexity of the reactions involved and the lack of satisfactory analytical procedures have hindered progress in studying the breakpoint phenomenon.

They followed the chlorine-ammonia reaction in a series of buffered distilled water samples with chlorine : ammonia ratios up to 11 to 1 and contact times varying from 1 to 24 hours at *p*H 7.0. To study the reaction the following analytical procedures were used : (1) the *o*-tolidin chlorine residual; (2) the Mark's titrator for free chlorine and chloramine; (3) potentiometric measurement of oxidation-reduction potential; (4) qualitative and quantitative *p*-amino-dimethylaniline test for free chlorine; and (5) the distillation procedure for free ammonia.

The Mark's titrator data showed no free chlorine until the breakpoint was passed. The chloramine results obtained with the Mark's titrator followed the *o*-tolidin results but in most cases were slightly lower. When the breakpoint was passed the Mark's titrator data indicated that no more chloramine was present. The quantitative determination of free chlorine by the *p*-amino-methylaniline hydrochloride method indicated a constant error of about 0.03 p.p.m. giving free chlorine results higher than the Mark's titrator.

Determining Iron in Water

F. J. Hallinan, of the New York State Department of Health, described a modified colorimetric procedure for the determination of iron in water. In this, 30 ml. of the sample is measured into a 2 oz. French square bottle of colourless glass; 20 ml. of 4 M HCl is added, and the sample is then heated for twenty minutes in a water bath at 99-100°C. After cooling to room temperature, add a drop of N/5 $KMnO_4$ solution or sufficient to maintain a pink colour for one minute; then add 5 ml. of 3 M KCNS solution. Compare at once with permanent colour standards in similar bottles. If more than 0.3 p.p.m. of iron is present transfer the sample to a 50 ml. Nessler tube and compare with colour standards in similar tubes; these standards, prepared from acid solutions of cobalt chloride, potassium chloroplatinate, and copper sulphate, are stable for at least six months, and cover the

range 0.03 to 4 p.p.m. of iron based upon the examination of 30 ml. The concentration of hydrochloric acid provides for complete solution of suspended iron at the given temperature of heating and eliminates the necessity for evaporation and subsequent adjustment of acid concentration. The method does not determine iron combined in silt, but this iron has little significance in problems of water use or distribution. One-tenth part per million or more copper produces a colour with thiocyanate that causes a marked difference in hue and is, therefore, readily detected. Thus, this routine test for iron also discloses the presence of excessive amounts of copper.

The use of water-fleas (*Daphnia*) to detect and estimate toxic materials in water was the subject of a paper read by B. G. Anderson, of Ohio State University. Tests were made on eleven substances known to be toxic to fish, and it was found that the water-fleas were far more sensitive than fish to ten of these substances and equally so in the case of the eleventh. Several industrial wastes were also tested and the degrees of dilution necessary to make them innocuous were determined. The test can also be used as a check on the adequacy of the treatment of a waste.

Chemicals and Sewage Disposal

The efficacy of various chemicals for sewage clarification was compared by H. G. Swope, who gave the results of plant-scale experiments in which 3-4 million gallons of sewage were treated in an Imhoff tank. Chemical treatment was used during six summers in order to improve flocculation and sedimentation of the solids. Trials were made with ferric chloride with and without lime, alum, alum and sodium silicate, ferrisul, plain flocculation (air and paddles but no chemicals) and chlorine (prechlorination). The best results, so far as suspended solids and biochemical oxygen demand removals are concerned, were with ferric chloride or with alum and sodium silicate. The differences in the purification obtained by some of the treatments tried are not great; consequently, the economy of the process may be the major factor in its selection. At the time alum and sodium silicate were used they were the cheapest chemicals, but the labour involved in preparing the "active" silica must also be considered.

T.N.T. Wastes

Because of the urgent need for some satisfactory economical means of treating large quantities of T.N.T. wastes, exploratory experiments on the effects of these wastes on sewage treatment devices and on possible chemical treatment were carried out. An account of these researches was given by S. Schott and C. C. Ruchhoft, of the U.S. Public Health Service. A typical analysis of the waste showed total solids of 1700 p.p.m., total ash of 892 p.p.m., and and only 29 p.p.m. of suspended solids. The acidity was 1700 p.p.m. with 610 p.p.m. of sulphates and 27 p.p.m. of nitrate nitrogen. Although the oxygen consumed value (by dichromate) was 121 p.p.m. the waste showed practically no 5-day biochemical demand. Extended B.O.D. incubation tests for a period of 129 days indicated very little biological breakdown and oxidation of this waste. The waste interferes with the ordinary Winkler procedure for dissolved oxygen, though the Rideal Stewart modification may be used on dilutions of the waste up to 4 to 8 per cent. Discharge of the waste with a 1/1000 dilution into streams used for public water supply would result in a colour greater than that permitted by the drinking water standard and impart a more pronounced taste to the water when the water is chlorinated. This was indicated by taste tests with individuals who were unaware of the source of the water they were drinking.

Because the T.N.T. isomers and their derivatives are largely in true solution, neutralisation and filtration or treatment of this waste with chemical coagulants is practically ineffective. The quantities of activated carbon required to remove effectively the coloured constituents prohibit this method of treatment. Chlorination of the waste results in considerable colour reduction and more work is indicated on this treatment. Experiments in which neutralised T.N.T. waste was added to sewage and treated by activated sludge indicated that 5 per cent. or more adversely affected the activated sludge process and that quantities up to almost 25 per cent. might be tolerated by the sprinkling filter at normal summer temperatures when dosed at a rate of one million gallons of sewage per acre per day.

A public meeting, organised by the Association of Scientific Workers, took place at Caxton Hall, London, recently, under the title, "Destroyer of Science." The speakers were well-known scientists and they drew attention to the ruthless attack of fascism on science, often pointing their arguments with personal experiences. Mr. J. G. Crowther, in the chair, recalled some of the published views of Hitler on science, and other speakers showed how these ideas had resulted in the stamping out of all original thought in the Nazi-controlled universities. A well-known French scientist painted a realistic picture of the frustration of scientists under Hitler and gave instances of the torture and murder of those whose independent spirit made it impossible for them to come to terms with the Nazi régime.

Industrial Research in India

Developments to Meet War Shortages

THE annual report for 1941-42 of the Director of Scientific and Industrial Research* gives many interesting details of industrial research being done in India's laboratories. The report itself is divided into two sections, the first dealing with the contributions of the Board of Scientific and Industrial Research (set up two years ago as a new division of the Council of Scientific and Industrial Research) to the development of Indian commerce, and the other being a technical report on research done under the guidance of the Director. The investigations carried out under the auspices of the Board essentially relate to the development of industrial products whose importance has been prominently brought to the fore as a result of conditions created by the war; no less than 62 research schemes, involving the expenditure of 1,920,000 rupees, were sanctioned during the year and investigations begun on them in the laboratories of a number of research institutes and universities throughout the country. In planning the research campaign the Board is assisted by nineteen research committees, each dealing with a specific subject; for instance, there is an industrial fermentation committee, another dealing with vegetable oils, and so on.

Vegetable Oils

Among the many problems investigated by the vegetable oils committee is the cracking of vegetable oils. The pressure-cracking of sesame oil, for instance, has been studied in the department of chemical technology at Bombay University, with a view to comparing the yields of the various cracking products at different pressures. An excellent binder for cold-moulding compositions has been obtained from the viscous residue resulting from the distillation of castor oil; boards and tiles have been made from it, while it has also yielded substitutes for india-rubber and waterproofing substances. Castor oil and ground-nut oil have been sulphonated with the aim of producing wetting auxiliaries for the textile industry. The cellulose content of Indian plants has been studied, and it is found that *kamti* bamboo gives the highest yield of α-cellulose, with the lowest ash content. Bagasse and Kasi grass come next and these may be preferable to bamboo for industrial purposes.

Investigations undertaken at the suggestion of the fertilisers committee covered processes such as the manufacture of ammonium phosphate and other phosphatic fertilisers from the extensive rock phosphates of Trichinopoly. By combining calcination with Wilfley Table methods, the calcium phosphate content of the ground (80-100 mesh) natural phosphate was increased from 59 to 80 per cent., giving a concentrate suitable for conversion into superphosphates, which can now be produced more cheaply than from bone ash. As sulphuric acid is not cheap enough in India to be used for making commercial superphosphate, experiments were carried out to find a method of making a quick-acting phosphatic fertiliser without its use. Promising results were obtained by sintering a mixture of ground phosphate rock, silica, potash felspar, gypsum and iron-manganese ore; a fertiliser containing as much as 16 per cent. citrate-soluble P_2O_5 is obtained, and it appears that most of the potash in the feldspar is converted into the citrate-soluble form by this treatment. Fluorapatite—$3Ca_3(PO_4)_2 \cdot CaF_2$—can be defluorinated, Indian chemists find, by calcining the natural mineral at about 1200° C. with water vapour and silica.

Plastics Development

Another committee is concerned with the development of plastics. Methods for making melamine and urea from calcium cyanamide have been examined, and, by one technique perfected experimentally, a yield of 5 lb. of urea from 30 lb. of commercial calcium cyanamide was obtained; the residual mother liquor, containing about 80 per cent. of a very hygroscopic solid, can be used with shellac for the production of moulding powders. Pilot-plant experiments were conducted on the production of formaldehyde from methyl alcohol; the product has been approved by the Indian Medical Service and will be sold to the Supply Department for war purposes. A method of making the same chemical from ethyl alcohol, a more accessible intermediate, has been worked out by Dr. H. K. Sen. A patented process for the manufacture of ammonium carbamate from ammonia and carbon dioxide has been perfected.

Graphite

The committee dealing with graphite, carbon, and electrodes initiated some pilot-plant scale work on carbon electrodes. Flotation methods have been used to purify graphite ores from the East Godavari area, the carbon content being raised from 63 to 99 per cent. in the finished product. Travancore graphite is flaky in character, but by modifying the flotation process enrichment of carbon content from 79 to 96 per cent. is found possible. Colloidal graphite

* *Journal of Scientific and Industrial Research*, 1943, 1, 2, p. 124.

has been prepared from the natural graphite, purified to 99 per cent. carbon content, by first heating the material at 900°C. to disintegrate it, grinding it to 150-200 mesh and then suspending it in a suitable liquid medium. In one process the suspension of graphite in water containing 6 per cent. tannic acid, is passed through a premier colloid mill a number of times, after the addition of ammonia to prevent flocculation. The coarser particles are separated out by sedimentation. The fine suspension is mixed with mineral lubricating oils, and the water removed by vacuum distillation. The addition of about 1 per cent. rubber (on the weight of graphite) in benzene solution was found to be beneficial for stabilising the suspension. Sodium oleate has also been tried as a dispersing and stabilising agent instead of tannic acid. Another method employed is to mix finely ground graphite (200 mesh) with a solution of rubber in benzene. Mineral lubricating oil was then added and the benzene subsequently removed by heating.

Arrangements have also been made for the commercial production of potassium chlorate by a process worked out at the Indian Institute of Science, Bangalore. A method of manufacturing sodium cyanide from wood charcoal, sodium carbonate, hæmatite and nitrogen has been designed which gives a yield of 60 per cent. Using a solvent extraction technique a commercially useful sodium cyanamide of 82 per cent. purity can be obtained from the product.

Lubricants and Laminates

The second half of the Director's report runs to ten printed pages, and only the most outstanding points can be summarised here. Two new substitute lubricants have been made by blending mineral oils with a mixture of castor and rape oil, and castor and groundnut oil respectively. A good stabiliser for these mineral-vegetable oil blends is α-naphthylamine, of which not less than 1 per cent. should be added. Tests carried out by Tata Iron & Steel Co. show that ground-nut oil can be used as fuel for diesel locomotives. In the plastics field, the work on laminated boards has been extended while the production of paper laminates has been taken up by Rohtas Industries, Ltd., J. K. Industries, and Karam Chand Thapar & Bros. New laminates include a jute-waste board which can be used for packing cases, acoustic insulation, etc. Two water-resistant plywoods, using shellac and rubber adhesives respectively, have been developed for the Director of Ship Building.

The production of $BaCl_2$ from India's barytes has been taken up by a firm in South India: the process used consists in heating a mixture of barytes, a reducing agent and a flux at 1000°-1100°C., extracting with boiling water and chlorinating the filtrate at a temperature of about 90°C. A yield of 89.2 per cen. is recorded, and for every ton of $BaCl_2$ produced about 190 lb. of sulphur are obtained as a by-product.

Sulphur Production

The sulphur situation has improved with the discovery of deposits in Baluchistan: a product, 99.5 per cent. pure, has been obtained by a process developed in the laboratories of the Director of Scientific and Industrial Research and operated by Delhi Cloth Mill chemical branch and Sepulchre & Co. The method removes the soluble impurities by a preliminary leaching. Work on the solvent extraction of sulphur and sulphur compounds from coal has continued, and using acetone as the solvent an extract amounting to over one per cent. of the coal resulted. Industrial applications for the fractions obtained by distilling the extract are being investigated.

It has been found possible to produce furfural from rice husk, straw, corn cobs, and cereal stalks by steam distillation of the hydrolysate produced by the action of high pressure steam; rice husk has yielded particularly promising results. Pilot plant trials for the production of phthalic anhydride (by vapour phase oxidation of naphthalene with vanadium pentoxide as catalyst) have been completed, and await commercial exploitation. Large scale production of chlorinated naphthalenes is to be taken up as soon as suitable chlorinating vessels, of a special type of stoneware, become available. A native seaweed, *Gracilaria lichenoides*, has been tested and proves to be a good source of agar-agar; by purification a bacteriological agar has been prepared from it.

Dry Cells

As a result of experiments made in the Director's laboratories, it is now possible for India to make dry cells comparable in quality to those imported. Of particular interest to the dry-cell manufacturing industry is the work done on the processing of manganese ores and on the production of carbon electrodes. A patented process has been developed for the treatment of natural manganese ores of medium quality by which an improvement of over 25 per cent. in the output over the untreated ore is claimed; treatment consists of the addition of an alkaline oxidising agent, after which the soluble materials are leached out with water. The work on the manufacture of carbon electrodes of high quality on a pilot plant scale was completed during the year, and of special interest is the work on the impregnation of carbon rods with paraffin wax, whereby the apparent density can be increased by 5-10 per cent., and mechanical strength improved by 10-15 per cent.

Estimating Glycerol in Soap Lyes

A New and Simple Technique

A RAPID and simple method of determining the amount of glycerol in crude glycerine and soap lyes is described by W. J. Govan in *Ind. Eng. Chem.* (Anal. Ed., 1943, *15*, 4, p. 260). The method depends on the fact that at a temperature of about 100°C. only the water evaporates from an aqueous glycerol solution, whereas at higher temperatures, around 160°C., the whole of the glycerol as well as the water is driven off. From the difference in weight of the two residues the percentage of glycerol in the sample can be calculated. The advantages of the method, which is accurate within 0.5 per cent., are that an estimation can be completed in about four hours, and that the apparatus is readily available.

Preparation of Sample

Soap lye, crude glycerine and saponification crude glycerine: 8 to 10 ± 0.001 g. are weighed into a tared 100-ml. measuring flask and about 50 ml. of water are added. The contents are well mixed, adjusted to the phenolphthalein end-point with dilute hydrochloric acid or sodium hydroxide, made up to the 100-ml. mark with more water, and thoroughly mixed.

Soap lye: 35 to 50 g. of lye are weighed into a tared 100-ml. measuring flask, the smaller sample for lyes of high salt content. The sample is adjusted to the phenolphthaline end-point with hydrochloric acid or sodium hydroxide. One or 2 ml. of a 10 per cent. aqueous solution of a wetting agent (Aerosol OT) are added, and the sample is made up to the 100-ml. mark with water and thoroughly mixed. The use of a wetting agent tends to reduce spattering.

Removal of Water

Two 5-ml. aliquot portions of the sample are pipetted into tared 60-ml. Erlenmeyer weighing bottles, and 5 ml. of methanol are added. The unstoppered bottles are placed in a natural convection drying oven maintained at 100° ± 2°C. The oven must have ample top and bottom vents for quick heat transfer, and its make-and-break contact points must be located below the samples for safety. Narrow strips of 0.6-cm. asbestos millboard placed on the metal shelf of the oven are effective in preventing spattering.

When the residue in the bottles is reduced to a thin syrupy consistency by evaporation and the characteristic sweet odour obtained when glycerol is heated under these conditions is faintly perceptible, the bottles are removed from the oven. (The time varies between 65 and 80 minutes.) Five millilitres of ethyl ether are then added and swirled in the bottom of the bottles for 2 minutes. The bottles are put back into the oven and dried at 100°C. for about 25 minutes, until the acrid odour of ether is no longer perceptible and the odour associated with glycerol vapour is again noticeable. The bottles are then brought to room temperature in a desiccator over concentrated sulphuric acid, stoppered, and weighed to the fourth decimal place. The drying with the addition of 5 ml. of ether is repeated until the loss in weight is less than 0.002 g. Usually, only one extra drying is necessary. The final weight, minus the tare, may be termed "residue at 100°C."

Removal of both Water and Glycerol

For this determination an infra-red drying oven is used in the following manner: The top and bottom of an ordinary tin can, 15 cm. in diameter and 17.5 cm. high, are cleanly cut out, and four inverted V notches, about 2.5 cm. in height, are cut from the base. The can is mounted on its notched end upon a porcelain or asbestos surface. A 250-watt infra-red reflector drying lamp is supported directly over the top opening of the tin can. A thermometer is inserted into one of the notches, so that its bulb rests directly beneath the centre of the drying lamp.

Two 5-ml. aliquot portions of the sample are pipetted into tared, shallow, flat-bottomed evaporating dishes of about 70 mm. diameter. The tin can is set aside and the evaporating dishes are placed close to and on each side of the thermometer bulb. The tin can is replaced and current to the lamp is switched on. Preliminary evaporation is done with the lamp at a distance of about 20 cm. from the dishes. When the residue is almost dry, the lamp is raised slightly to prevent spattering of salt crystals. The temperature up to this point is disregarded. When the fumes of glycerol are scarcely to be seen coming off, the reading of the thermometer is brought to 160°C. by adjusting the height of the lamp. This temperature is maintained for 30 minutes, after which the evaporating dishes are removed, cooled to room temperature in a desiccator over concentrated sulphuric acid, and weighed rapidly to the fourth decimal place. This weight minus the tare may be termed "residue at 160°C." The over-all drying time rarely exceeds 90 minutes. (An alternative method of carrying out the operation of removing both water and glycerol has been described by W. J. Govan in *Oil and Soap*, 1942, *19*, 27).

The percentage of glycerol in the sample is the quotient of the expression:

$$\frac{20\ (\text{residue at } 100°\text{C.} - \text{residue at } 160°\text{C.})}{\text{wt. of sample.}}$$

Personal Notes

MR. BERNARD CHASE, a member of the Waste Rubber Merchants' Association, has been appointed a member of the Rubber Control Advisory Committee.

MR. WALTER C. WENDERHALL, director of the U.S. Geological Survey, has retired at the age of 72 after 48 years' service in that organisation. DR. JULIAN SEARS will be acting director until a new director is appointed.

DR. D. T. A. TOWNEND, Livesey Professor of the Department of Coal, Gas, and Fuel Industries with Metallurgy, at the University of Leeds, has been elected an Honorary Member of the Institution of Gas Engineers.

DR. W. G. OGG, M.A., B.Sc., D.Phil., director of the Macaulay Institute for Soil Research, Aberdeen, has been appointed to succeed Sir John Russell as director of the Rothamsted Experimental Station on Sir John Russell's retirement at the end of September.

PROFESSOR SIR LAWRENCE BRAGG, O.B.E., D.Sc., F.R.S., and PROFESSOR C. G. DOUGLAS, C.M.G., M.C., F.R.S., have joined the Council of the Gas Research Board, as a result of the recent association of the Board with the Department of Scientific and Industrial Research.

MR. MELVIN E. CLARK has been appointed head of the newly-formed programme section of the U.S. War Production Board's chemical division. The main functions of the new section are to compile estimates of supply and demand for the output of the chemical industry and make proposals for reconciling these two factors.

MR. T. AINLEY assumes the duties of national organiser of the Association of Scientific Workers at the end of this month, in succession to MR. EEN SMITH who is joining the Forces. Mr. Ainley, who at present organises the Manchester district branch of the Shop Assistants' Union, has had many years' experience of trade union work.

At the last meeting of the Electrodepositors' Technical Society the following elections were announced: President, DR. J. R. I. HEPBURN; vice-presidents, DR. G. E. GARDAM, DR. S. WERNICK; hon. treasurer, MR. F. L. JAMES; hon. secretary, DR. S. WERNICK; chairman, Midlands Centre, MR. E. A. OLLARD; hon. secretary, Midlands Centre, MR. H. J. BACHE.

Obituary

MR. JOHN ALEXANDER GALT, works engineer, Tubes, Ltd., Aston, Birmingham, died suddenly at Birmingham on June 10, aged 45.

New Control Orders

Glue and Gelatine

A new Order, the Control of Glue, Gelatine and Size (No. 1) Order, 1943 (S. R. & O. 1943, No. 816), issued by the Minister of Supply, prohibits, except under licence, as from July 1, the acquisition, disposal and consumption of animal glues and gelatines and fish glue in excess of the following quantities per quarter; glues and gelatines other than edible gelatine and fish glue 6 tons; edible gelatine 5 cwt.; fish glue 3 cwt. The Order does not apply to gelatine or stock arising in the course of the manufacture of meat products or used in these meat products; nor does it apply to gelatine prepacked under licence granted by the Minister of Food. Applications for licences should be sent to the Ministry of Supply, R.M. 2C, Carlton House Terrace, S.W.1, from which address application forms may be obtained.

Chemicals in Italy

Cellulose Difficulties

NEW difficulties have been encountered in the Italian cellulose industry, and Cellulosa d'Italia (Celdit), the important company formed in 1939, is now to be liquidated. Its factories at Mantua and Cuneo will be handed over to the Burgo paper combine, which has raised its capital by 50 million lire, while the works at Capua are to be transferred to the Chatillon rayon company. It is reported that the works at Cuneo are not yet in operation. Burgo holds an important interest in CELNA (Cellulosa Nazionale), a 30 million lire company, but no news about the progress of this company is available at present. Meanwhile in the production of cellulose from reeds several million lire have been jointly provided by Burgo, the rayon firm of Snia Viscosa, and the state-sponsored Institute for Industrial Reconstruction; it is claimed that the use of reeds may in a short time make Italy self-sufficient in cellulose for paper and artificial fibre.

Certain chemical products used in the production of synthetic rubber, including turpentine spirit, may be imported to Italy free of import duties. A substitute for coal gas used for lighting has been offered by Professors Tramontano and Angeli, of Siena University, in the form of charcoal gas; during a demonstration in Rome it was stated that the light derived from it was perfect and the cost insignificant.

Coke ovens and benzol installations at Zeebrugge, Belgium, were among last week's daylight targets for Ventura bombers operating on offensive sweeps.

General News

From Week to Week

The employees of I.C.I. (General Chemicals), Ltd., Glasgow, who set themselves a "Wings for Victory" target of £2000, achieved a total of £3913.

No change in the Board of Trade index numbers for the wholesale prices of chemicals and oils, iron and steel, or non-ferrous metals falls to be recorded during May.

Nucleus factories selected under the soap concentration scheme number 44, and of these eight are either controlled by, or belong to, subsidiary companies of Unilever.

Sir Edward Appleton, secretary of the D.S.I.R., will open new laboratories for physico-chemical research at the B.C.U.R.A. premises, Coombe Lane, Kingston-on-Thames, at 4 p.m. on June 23. A producer-gas bus will meet visitors at Malden Station between 2.45 and 3.45 p.m.

A report on the expansion of the chemical industry in Edinburgh is to be presented by the Governors of the Heriot-Watt College to the recently established advisory committee on city development. Extension of the coal by-products industries in the Fife and Lothians coalfields is regarded as of major importance to the city in any future scheme of chemical development.

A glimpse of an underground gasification of coal plant is given in the Russian film "Coal," which is creating widespread interest in technical circles in this country. In the last month it has been shown to several meetings of chemical and gas engineers. The film, which also shows the cutting of coal by hydraulic means, is distributed by the Soviet Embassy's film agency.

Microfilm copies of British scientific publications are being sent to China to meet the difficulties which Chinese scientists experience in obtaining current literature. It is interesting to note that microfilm is also being used by the Commission Internationale des Industries Agricoles for their documentation service; scientific papers can thus be circulated in a compact and convenient form, each page of the original paper being reduced to a photographic image, 18 by 24 mm.

A Thomas Gray Memorial Prize of £50 is offered by the Royal Society of Arts to any person of British or Allied nationality who may bring to the notice of the Council an invention which in the opinion of the judges is considered to be an advancement of the Science or Practice of Navigation and has been invented by the applicant in the period January 1, 1938-December 31, 1943. Competitors must forward their claims to the Acting Secretary, R.S.A., between October 1 and December 31, 1943.

A higher scale of wages will apply to chemists employed in Granton Gasworks, Edinburgh, following an application by the National Union of Public Employees. The current scale of £215, rising to £315, is to be increased to a basis of £300, rising to £400.

The Ministry of Food has taken over as a cereals research station the extensive laboratories at St. Albans hitherto carried on by the flour milling industry. It will be under the direction of Dr. T. Moran, previously director of research of the Research Association of the British Flour Millers and now director of research to the Ministry.

Large scale poisoning of agricultural crops at Black Notley, Essex, directs attention to the need for expert advice before industrial wastes are applied to farm land. Some 14 acres of land are badly affected and analysis has revealed the presence of zinc, copper, and chromium in the soil. A Ministry of Agriculture spokesman advanced the theory that sweepings or sludge from a foundry may have been put on the land.

The Trading with the Enemy (Specified Persons) (Amendment) (No. 8) Order, 1943 (S.R. and O., 1943, No. 736), which came into force on May 31, contains about 300 additions to the black list, among them Industria Metalurgica Argentina, Alsina 2681, Buenos Aires. The deletions, numbering 92, include Metalurgica Mar S.A., Ave. Rangel Pestana 1086-8, and Rua Claudina Pinto 183-193, Sa. Paulo, Brazil.

Foreign News

The combined United Kingdom and United States steel mission has arrived in New Delhi for consultation with the Government, says Reuter.

A bill to establish an Office of Scientific and Technical Mobilisation with the object of planning the most effective use of America's scientists has been introduced in Congress by Senator Kilgore. *Chem. Met. Eng.* describes the bill as tending to socialise scientific and technical work hitherto considered to be the exclusive concern of private enterprise, and comments "Washington does not believe this bill will pass, but feels that it will have to be carefully watched."

The fiftieth anniversary of the "single-bath" chrome process for commercial tanning has been celebrated by the Martin Dennis Co., Newark, N.J., U.S.A., the world-famous makers of chemical specialities for tanners. It was in 1893 that Martin Dennis took out patent rights for a solution of basic chromium chloride for tanning, and a solution prepared under his specification was the first marketed under the name of "Tanolin."

The Belgian match trust, Union Allumettière, reports a heavy increase in the production of fibreboards. The match factories are suffering from increased raw material difficulties.

German technicians, Reuter reports, are flooding into Sofia to "buy up" all Bulgarian plants which can be converted into German war factories. The plants are needed to replace German factories damaged and destroyed in Allied air raids.

A German-owned company, Weissruthenische Seifen- und Fettindustrie G.m.b.H., has been formed at Minsk (White Russia), with a capital of 100,000 RM, for the production of soap, glycerine, and cleansing agents.

A new substitute lubricant called "Alipol," which is made of rosin, is described in the French journal, *La Garonne*. Experiments have given satisfactory results, and Alipol is to be used as a lubricant for all kinds of machinery in spinning-mills.

A company styled "Deutsch-Griechische Waren Ausleich G.m.b.H." has recently been founded with offices in Athens and Berlin. It is not a trading company and its object will be to equalise prices of German and Greek chemical products.

The Italian hydrogenation company "Anic," in which the State-owned AGIP, the State railways, and Montecatini are interested, reports having started the production of aviation petrol. The new plant was paid for out of current profits, and technical improvements are said to have resulted in a further increase of production.

Fertiliser production, according to the report of the Société Chimique de la Grande Paroisse, Paris, has been more or less maintained, but extension work is impossible owing to shortage of construction materials. The production of synthetic fuels was higher. At St. Hilaire about 80 tons of shale are treated every day, with satisfactory results.

A plastic lithographic plate, which saves from 3 to 8 times its weight in aluminium and zinc, has been announced by E. I. du Pont de Nemours and Co. The plates are manufactured by the Plastolith Co. of Boston (Mass.) from polyvinyl alcohol resin; they give approximately the same number of impressions as metal plates and carry about 25 per cent. more ink without smudging.

Rhenium, a rare metal hitherto imported exclusively from Germany, has now been extracted in the U.S.A. from flue dust obtained in the roasting of a molybdenum ore. The metal, physically and chemically, bears some resemblance to molybdenum, tungsten, and manganese. Its high melting point is exceeded among metals only by that of tungsten, and its density is surpassed only by that of platinum, iridium, and osmium.

Mulhouse, the Alsatian textile town now in German occupation, has recently been endowed with a University Institute for textile chemistry. While formerly research work here was confined to the constitution, synthesis, structure, and discovery of dyes, the present task is to initiate and to produce them artificially, *i.e.*, by an industrial process, thereby increasing the extent of their applications.

Ten new fellowships began operation at the Mellon Institute, Pittsburgh, U.S.A., during the fiscal year 1942/43. These deal with alumina, cellulose moulding, chemical storage, coal products analysis, coke plant, physical technology, molasses technology, nickel, pencil technology, special lubricants, and synthetic rubber hygiene. The annual report, for security reasons, is almost purely formal.

Tervalent silver compounds have been obtained by two Indian chemists, K. Chakravorty and P. Ray, of the University College of Science, Calcutta. In *Nature* (1943, *151*, p. 643) the experimenters claim to have prepared a number of 4-co-ordinated silver ethylene biguanidine salts in which the central silver atom shows a primary valency of three. The salts, unlike those of divalent silver, are diamagnetic, a fact which furnishes strong confirmation of the tervalency of the silver in them.

Forthcoming Events

The next meeting of the London branch of the **Electrodepositors' Technical Society** takes place at the Northampton Polytechnic, London, E.C.1, on **June 21**, at 5.30 p.m., when a paper will be presented on "Some Applications of Chromium Plating in Ordnance Manufacture," by Dr. David D. Howat, F.I.C., A.M.I.Chem.E.

The 221st ordinary general meeting of the **Society of Glass Technology** will be held at "Elmfield," Northumberland Road, Sheffield, 10, on **June 23.** Papers will be read at 11 a.m. by Dr. E. J. Gooding on the Influence of the Soda Content of Certain Glasses, and in the afternoon, starting at 2 p.m., by Mr. J. B. Murgatroyd (two papers on The Effect of Shape on Thermal Endurance), and Mr. M. Parkin, A.I.C. (Hydraulic Pressure Testing).

The British Coal Utilisation Research Association has arranged a conference on the ultra-fine structure of coals and cokes, to be held at the Royal Institution, Albemarle Street, London, W.1, on **June 24** and **25.** The conference will be opened at 10.30 a.m. on the first day, and a disucssion on "Colloid Properties" will take place at 2.30 in the afternoon. At 10 a.m. on June 25 there will be a discussion on "X-Ray Diffraction Investigations," and another on "Physical Properties," at 2.30 p.m.

Company News

Turner and Newall, Ltd., announce an interim dividend of 3¾ per cent. (same).

The profit of **Goodlass Wall and Lead Industries** for 1942 was £121,792 (£105,339), and, as already announced, the dividend was 7 per cent.

The Eaglescliffe Chemical Co., Ltd., announce a net profit for 1942 of £11,813 (£7323). A final dividend of 3½ per cent. is declared, making 6 per cent. (5 per cent.). Forward, £19,078 (£11,765).

The Fullers' Earth Union, Ltd., record a net profit, for the year ended March 31, of £20,789 (£19,607). Final dividend, 11 per cent. on ordinary, making 15 per cent. (same). Forward, £3019 (£3928).

The preliminary statement of **Thomas de la Rue and Co.**, covering the period from December 28, 1941, to March 27, 1943, shows that the profit will be not less than £300,000. In the previous accounting period of 21 months a trading profit of £258,091 was returned. A final dividend of 25 per cent. (nil) is being paid, making a total of 35 per cent. (nil).

New Companies Registered

Foynes Products, Ltd. (380,905).—Private company. Capital: £100 in 100 shares of £1 each. Manufacturers of and wholesale and retail dealers in chemicals, disinfectants, dyes, fertilisers, plastics, oils, grease, soap, and synthetic products, manufacturing chemists, etc. Subscribers: J. J. Lorant, 5 Kensington Park Gardens, W. 11; J. E. Saytch.

Beacon Chemical Company, Ltd. (380,612).—Private company. Capital: £1200 in 1200 shares of £1 each. Colliery, mine and quarry owners, manufacturers of coal by-products, tar, tar distillates and residual products, chemical manufacturers, etc. Subscribers: Lottie Moorhouse; A. Tame. Solicitors: Parsons, Evans and Francis, 13 George Street, W.1.

Daniel Varney, Ltd. (380,887).—Private company. Capital: £10,000 in 9500 5 per cent. redeemable cumulative preference and 500 ordinary shares of £1 each. Manufacturing, consulting, electrical and general engineers, metallurgists, chemists, research workers, scientific and industrial instrument makers, etc. Subscribers: R. Witt; J. Borthwick. Solicitors: Stephenson, Harwood and Tatham, 16 Old Broad Street, E.C.2.

Vaccine Private Immunisation Clinic and Research Laboratories, Ltd. (380,518).—Private company. Capital: £1000 in 1000 shares of £1 each (300 "A" and 700 "B"). To investigate systems for reducing industrial absenteeism by pre-seasonal immunisation against catarrhal illness, to carry out research work in connection with industrial occupational diseases, etc. Directors: H. H. Murray; W. R. Oliver; Cecilia Brady; Registered office: 8 Buckingham Palace Gardens, S.W.1.

Chemical and Allied Stocks and Shares

SENTIMENT in the stock and share markets has been inclined to show response to the encouraging trend of the war news and, where changed, various shares of companies connected with the chemical and kindred industries were better on balance. Imperial Chemical moved up from 38s. 6d. to 39s. 3d. Buying was attributed to yield considerations; the return on the basis of the 8 per cent. dividend, though moderate, is in excess of the yields obtainable on numerous other leading industrial shares. Lever & Unilever remained at 34s., while Lever N.V., after rising to 33s., eased to 32s. 3d. Dunlop Rubber at 36s. held their recent rise, aided by the statements at the annual meeting. Borax Consolidated at 34s. were little changed on balance, as were British Aluminium at 49s. British Oxygen moved back from 75s. 6d. to 74s. 3d.

Thomas De La Rue shares recorded a large advance on balance, the dividend of 35 per cent. for the past financial period being in excess of general expectations and equivalent to 28 per cent. per annum. Among other shares connected with plastics, British Industrial were fairly active around 5s. 10½d., while Erinoid were again 11s. 6d., and Lacrinoid Products 4s. 4½d. Among shares of companies whose dividend announcements and results are impending, Barry & Staines were 40s. 6d., and Allied Ironfounders 48s., while at 28s. British Plaster Board 5s. ordinary maintained the better tendency which developed last week. B. Laporte remained at 78s. and were held firmly, as were W. J. Bush shares, which kept their recent rise to 53s. 9d. Business at 11s. 9d. was recorded at one time in Lawes Chemical. Burt Boulton were around 19s., and Monsanto Chemicals 5½ per cent. preference remained at 22s. 6d. Pending the dividend declaration, British Glues & Chemicals 4s. ordinary again tended to move higher and were quoted at 8s. 1½d. Movements in iron and steel shares were moderate: Babcock & Wilcox were firm at 48s. 3d., Dorman Long 27s. 6d., Guest Keen 33s. 1½d., Stewarts & Lloyds 50s. 4½d., Tube Investments 91s. 6d., and United Steel 26s. 4½d.

In other directions, Turner & Newall were firm, maintenance of the interim dividend being in accordance with general expectations. Cerebos shares were around £9½ on the full results and the maintenance of the dividend at 40 per cent. Cooper McDougall & Robertson kept at 29s., it being

pointed out that although the dividend is again limited to 5 per cent., actual earnings on the ordinary shares exceeded 13 per cent. last year. Most companies are, of course, following the prudent policy of placing a good proportion of profits to reserve funds. Although this limits dividends for the present, there can be no doubt that the building up of strong finances will be of ultimate benefit, particularly in view of the difficult period that may have to be faced during the eventual change-over from war to peace conditions.

Movements in textile shares have been moderate. Courtaulds were 49s. 3d., and British Celanese 21s. 6d., while British Enka improved to 11s. Calico Printers preference were firm at 18s. 6d. on hopes that later in the year there may be a further payment on account of dividend arrears. Elsewhere, Wall Paper Manufacturers deferred eased to 36s. 9d. following their recent rise. Associated Cement were little changed at 56s. 6d. and were firmly held, in common with numerous other shares which tend to be governed mainly by hopeful views as to the possible scope for recovery in earnings and dividends after the war. Morgan Crucible preference shares were again firm, awaiting the financial results. The units of the Distillers Co. showed small movements, pending the dividend declaration, and at 84s. 9d. were little changed on balance, while United Molasses 6s. 8d. units were 28s. 10½d. Boots Drug were firm at 40s. 9d., having remained under the influence of the higher earnings and the maintained distribution for the past year. Sangers were 20s. 4½d., and Timothy Whites 28s. 1½d. Among oil shares, Anglo-Iranian and Burmah Oil were slightly higher on balance.

British Chemical Prices

Market Reports

A MODERATE volume of inquiry has been dealt with during the past few days on the London general chemical market, and a certain amount of contract buying of heavy chemicals is reported. The movement into consumption has been satisfactory, and consumers are taking steady deliveries. In the soda products section there has been no easing of the supply position of yellow prussiate of soda, while the demand for caustic soda and chlorate of soda has been maintained. Bicarbonate of soda and soda ash are brisk items, and a good inquiry is reported for Glauber salt and salt cake. There has been little change in the market for potash chemicals. British makers of permanganate are well booked and a fair volume of fresh inquiry is circulating. Solid caustic potash and yellow prussiate of potash remain in short supply, while acid phosphate of potash is steady. In other directions white powdered arsenic, calcium carbide, and sulphur are all very strong sections, while good quantities of acetone are being absorbed. Among the non-ferrous metals, a steady trade is passing in the red and white leads, with no change in the price position. Pressure for contract deliveries is the chief feature of the coal-tar products market and the firm price position is maintained. The demand for the xylols, benzols, and toluols is steady, while a brisk movement in supplies of creosote oil and cresylic acid is reported.

MANCHESTER.—Generally firm price conditions have been reported during the past week on the Manchester chemical market, though there has been little actual movement compared with recent weeks. The Whitsun holidays have been observed pretty well as usual by industrial users of chemicals and this has been reflected not only in the flow of contract delivery specifications but also in the volume of inquiry, new bookings having been comparatively small as a result. These conditions have also made themselves felt in the by-products section, though from the point of view of consumption in most classes of material the outlook is satisfactory.

GLASGOW.—In the Scottish heavy chemical trade there was a slight improvement during the past week for home business. Export trade is still rather restricted. Prices remain firm with no actual changes to report.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

ANALYTICAL BALANCES—immediate delivery for work of National importance, various models available. J. W. TOWERS & CO., LTD., Widnes.

FOR Sale about 100-lbs. EASONE B. Sample and price on request. Also 1-cwt. Sylphoncyanine Black B. Please reply to Box No. 2123, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4

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LARGE surplus Stocks of 1 drachm to 16 ozs. Bottles, Jars and Tin or Fibre Boxes in "as new" condition. Complete with closures preferred. Highest prices paid, send your offers to GALE & MOUNT (INDUSTRIAL SALVAGE), LTD., Carlton House, Lower Regent Street, London, S.W.1.

FIRM want to rent chemical plant either installed in Midlands factory, or plant only, to include dry mixer, leaching tanks, lead lined vats, filter presses, all capable of handling ordinary acid and alkaline liquors and live steam. Details please to Box No. 2120, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

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GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Bochurch, London." Telephone: 3285 East.

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WORKING NOTICE

THE Proprietors of British Patent No. 518,567 for "A PROCESS FOR MODIFYING FLESHY LEAVED PLANT JUICE," desire to enter into negotiations with a Firm or Firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from MARKS & CLERK, 57 & 58 Lincoln's Inn Fields, London, W.C.2.

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